

## Silicon Whisker and Carbon Nanofiber Composite Anode, Phase II

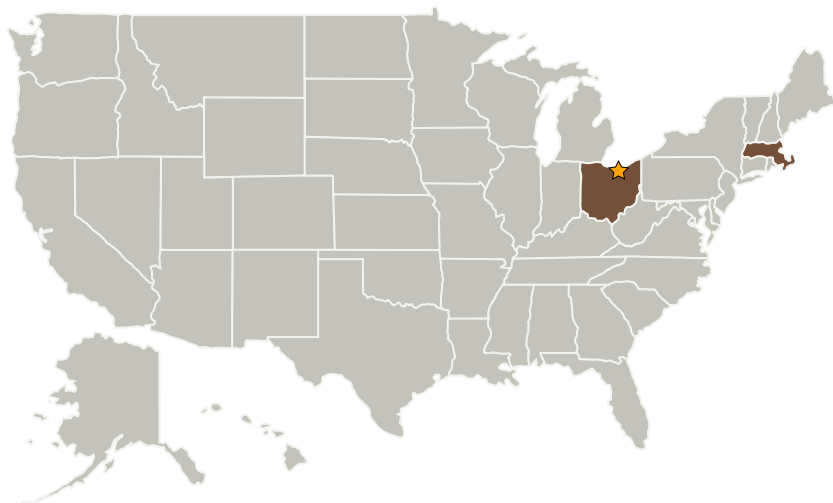
Completed Technology Project (2009 - 2011)



## Project Introduction

Physical Sciences Inc. (PSI) has successfully developed a silicon whisker and carbon nanofiber composite anode for lithium ion batteries on a Phase I program. PSI has demonstrated a technology readiness level of 3 with an anode composite capacity of greater than 1100 mAh/g for over 200 cycles (100% depth-of-discharge) at 1C using 2 mAh cells. This anode provides high capacity, high power, and improved cycle life at a competitive cost. Silicon is low cost and has a theoretical capacity of 4200 mAh/g but it has a limited cycle life. The nanocomposite design provides a synergistic improvement in reversible capacity and electrochemical cycling as a result of the unique silicon architecture and structural reinforcement provided by the nanofibers. In the Phase II program, PSI will increase cell size to 2.5 mAh and optimize cell design to further improve cycle life. PSI will deliver to NASA 2.5 Ah lithium ion cells with an energy density greater than 220 Wh/kg that is required by NASA's future robotic and human exploration missions. In collaboration with a battery manufacturer, PSI will also demonstrate that this anode technology is scalable to reach industrial production level.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

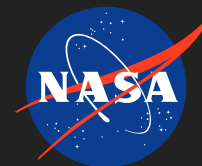
**Lead Center / Facility:**

Glenn Research Center (GRC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

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| Organizations Performing Work | Role                    | Type        | Location               |
|-------------------------------|-------------------------|-------------|------------------------|
| ★ Glenn Research Center(GRC)  | Lead Organization       | NASA Center | Cleveland, Ohio        |
| Physical Sciences, Inc.       | Supporting Organization | Industry    | Andover, Massachusetts |

## Primary U.S. Work Locations

|               |      |
|---------------|------|
| Massachusetts | Ohio |
|---------------|------|

## Project Transitions

 **December 2009:** Project Start **December 2011:** Closed out

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX13 Ground, Test, and Surface Systems
  - └ TX13.4 Mission Success Technologies
    - └ TX13.4.2 Team Preparedness and Training